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IS/IEC 62255-1 (2003): Multicore and Symmetrical Pair/Quad Cables for Broadband Digital Communications(High Bit Rate Digital Access Telecommunication networks) -- Outside Plant Cables, Part 1: Generic Specification [LITD 6: Wires, Cables, Waveguides and Accessories]

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भाग 1 जेनेरिक विशिष्टि

Indian Standard

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR BROADBAND DIGITAL COMMUNICATIONS (HIGH BIT RATE DIGITAL ACCESS TELECOMMUNICATION NETWORKS) — OUTSIDE PLANT CABLES

PART 1 GENERIC SPECIFICATION

ICS 33.120.10

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 2011 **Price Group 6**

Wires, Cables, Waveguides and Accessories Sectional Committee, LITD 06

NATIONAL FOREWORD

This Indian Standard (Part 1) which is identical with IEC 62255-1 : 2003 'Multicore and symmetrical pair/quad cables for broadband digital communications (high bit rate digital access telecommunication networks) — Outside plant cables — Part 1: Generic specification' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Wires, Cables, Waveguides and Accessories Sectional Committee and approval of the Electronics and Information Technology Division Council.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in the Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated. For undated references, the latest edition of the referenced document applies.

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60304 Standard colours for insulation for low frequency cables and wires	IS 9938 : 1981 Recommended colours for PVC insulation for low-frequency wires and cables	Technically Equivalent
IEC 60344 Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires	IS 9941 : 1981 Guide to the calculation of resistance of plain and tinned copper conductors of low-frequency cables and wires	do

The technical committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
IEC 60028	International standard of resistance for copper
IEC 60050-300 : 2001	International Electrotechnical Vocabulary — Electrical and electronic measurements and measuring instruments — Part 311: General terms relating to measurements Part 312: General terms relating to electrical measurements Part 313: Types of electrical measuring instruments Part 314: Specific terms according to the type of instrument

(*Continued on third cover*)

Indian Standard

MULTICORE AND SYMMETRICAL PAIR/QUAD CABLES FOR BROADBAND DIGITAL COMMUNICATIONS (HIGH BIT RATE DIGITAL ACCESS TELECOMMUNICATION NETWORKS) — OUTSIDE PLANT CABLES

PART 1 GENERIC SPECIFICATION

1 Scope

This part of IEC 62255 is applicable to polyolefin insulated symmetrical pair/quad telecommunication cables, filled or unfilled with copper conductor intended for broadband digital communications in the local outdoor network.

It provides definitions of characteristics, establishes general requirement for materials and cable construction, and details test methods and procedures.

Cables are differentiated by bandwidth. They have a maximum referenced frequency of 30 MHz, 60 MHz and 100 MHz.

The local cables covered by this standard are divided into two types based on cable design – filled and unfilled.

These cables have typically 6 to 300 pairs.

The drop cables covered by this standard are divided into two types based on method of installation – aerial and buried.

Drop cables typically have a pair-count of 2 to 6 pairs.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60028, *International standard of resistance for copper*

IEC 60050-300:2001, *International Electrotechnical Vocabulary – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC 60189-1:1986, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 1: General test and measuring methods*

IEC 60304, *Standard colours for insulation for low frequency cables and wires*

IEC 60332-1-1, *Tests on electric and optical fibre cables under fire conditions – Part 1-1: Test for vertical flame propagation for a single insulated wire or cable – Apparatus*

IEC 60708:2005, *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath*

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric and optical cables – Part 1-1: Methods for general application – Measurement of thickness and overall dimensions – Test for determining the mechanical properties*

IEC 60811-1-3:1993, *Common test methods for insulating and sheathing materials of electric and optical cables – Part 1-3: General application – Methods for determining the density – Water absorption tests – Shrinkage test*

IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Tests at low temperature*

IEC 60811-4-2:2004, *Insulating and sheathing materials of electric and optical cables – Common test methods – Part 4-2: Methods specific to polyethylene and polypropylene compounds – Tensile strength and elongation at break after conditioning at elevated temperature – Wrapping test after conditioning at elevated temperature – Wrapping test after thermal ageing in air – Measurement of mass increase – Long-term stability test – Test method for copper-catalyzed oxidative degradation*

IEC 61156-1:2002, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

IEC 61156-5:2002, *Multicore and symmetrical pair/quad cables for digital communication – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring – Sectional specification*

IEC 62012-1:2004, *Multicore and symmetrical pair/quad cables for digital communications to be used in harsh environments – Part 1: Generic specification*

IEC 62153 (all parts), *Metallic communication cables test methods*

3 Terms and definitions

For the purposes of this document, the following definitions given in IEC 61156-1 and some of the definitions given in IEC 60050-300 apply.

Table 1 – Definition of electrical and transmission properties

Parameter	IEC referenced standard	Subclause
Resistance unbalance	61156-1	2.1.1
Pair or one side of a quad to earth capacitance unbalance	61156-1	2.1.2
Pair or one side of a quad to screen capacitance unbalance	61156-1	2.1.3
Mutual capacitance of a pair	61156-1	2.1.4
Velocity of propagation (phase velocity) 1	61156-1	2.1.5
Attenuation	61156-1	2.1.6
Unbalance attenuation	61156-1	2.1.7
Near-end crosstalk loss (NEXT)	61156-1	2.1.8
Far-end crosstalk loss (FEXT)	61156-1	2.1.9
Power sum of near-end and far-end crosstalk	61156-1	2.1.10
Characteristic impedance	61156-1	2.1.11
Surface transfer impedance	61156-1	2.1.12
Group propagation delay	61156-1	2.1.13
Differential phase delay (skew)	61156-1	2.1.16

4 Installation considerations

The requirements are under consideration. In the meantime, IEC 60794-1-1 should be used as guidance.

5 Materials and cable construction

5.1 General remarks

The choice of materials and cable construction shall be suitable for the intended application and installation of the cable. Particular care shall be taken to meet any special requirements resulting from the local climatic conditions or method of installation.

5.2 Cable construction

The cable construction shall be in accordance with the details and dimensions given in the relevant detail specification.

5.3 Conductor

The conductor shall be a solid annealed copper conductor in accordance with IEC 60028.

The conductor shall have a nominal diameter between 0,5 mm and 0,9 mm.

Joints in the uninsulated conductors are allowed. Joints in uninsulated conductors shall be free from lumps and sharp projections.

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1 The velocity of propagation, group velocity and phase velocity are approximately equal for frequencies greater than 1 MHz when measured on symmetric cables, i.e. when the cables are operated in a balanced mode.

The tensile strength of any conductor containing a joint shall not be less than 90 % of the tensile strength of an adjacent length of conductor outside the joint area.

5.4 Insulation

The conductor shall be insulated with a suitable polyolefin material.

The type of conductor insulation shall be either solid or cellular or any combination thereof. The insulation may be made with or without a solid dielectric skin. The skin material may be different from the base material. Other multilayer insulating systems may be used.

The insulation shall be continuous and shall have a thickness such that the finished cable meets the specified requirements.

Joints in insulated conductors are allowed. Joints shall be free from lumps and reinsulated with a dielectric material.

The nominal thickness of the insulation shall be compatible with the method of conductor termination.

5.5 Colour code

The colour code is not specified but shall be indicated in the relevant detail specification. The colours shall be readily identifiable and should correspond with the standard colours shown in IEC 60304.

5.6 Cable element

The cable element shall be a twisted pair or quad.

Variable lay length or oscillated pairing or quadding is allowed.

5.7 Cable make-up

The cable elements shall be assembled to form the cable core. The cable may contain water swellable materials in order to prevent longitudinal water migration.

The core of the cable may be wrapped with a protective layer of non-hygroscopic material.

5.8 Filling compound type

The core of the cable may be filled with a suitable filling compound.

Examples of suitable filling compounds are:

- polyethylene/petroleum jelly;
- extended thermoplastic rubber;
- absorbent thixotropic gel;
- superabsorbent polymers.

The type of filling compound shall be indicated in the relevant detail specification.

The filling compound shall be compatible with all the component materials with which it is in contact.

5.9 Flooding compound

A flooding compound may be provided as a moisture barrier. The flooding compound shall be a uniformly mixed compound. The flooding compound shall be compatible with all the component materials with which it is in contact.

The flooding compound shall have sufficient adhesive properties to meet the requirements of the sheath-adherence unbonded requirement specified in the relevant sectional specification.

5.10 Screening of cable core

A screen for the cable core may be provided.

A protective buffer (wrapped, longitudinally applied, or extruded) may be applied under and/or over the screen.

5.11 Sheath

The sheath material shall consist of a suitable thermoplastic material. Examples of suitable materials are:

- polyolefin;
- PVC.

The sheath shall be continuous, having a thickness as uniform as possible.

The sheath shall be applied to fit closely to the core of the cable.

The sheath may have an additional layer of polymeric material, for instance polyamide, in order to meet a unique performance requirement.

5.12 Ripcord

Ripcord(s) may be provided. Ripcord(s) shall be non-hygroscopic and non-wicking.

5.13 Colour of sheath

The colour of the sheath shall be black, unless otherwise stated in the relevant cable specification.

5.14 Strength member

The sheath of cables may contain strength member(s). The strength member(s) may consist of a solid or stranded steel wire, which may be coated or bare. Alternatively, the strength member may consist of glass or synthetic fibre, which may have a polymeric coating.

5.15 Identification

Each length of cable shall be identified as to the manufacturer, and when required, the year of manufacture, using one of the following methods:

a) appropriately coloured threads or tapes;
b) printed tape;
c) printing on the cable core wrapping;
d) marking on the sheath.

Additional markings are permitted on the cable sheath.

5.16 Packaging of the finished cable

The finished cable shall be adequately protected for storage and shipment.

6 Test methods

6.1 Electrical tests

Unless otherwise specified, the tests shall be carried out on a cable length of not less than 100 m.

6.1.1 Conductor resistance

The measurement of conductor resistance shall be carried out in accordance with 5.1 of IEC 60189-1.

6.1.2 Resistance unbalance

The measurement of resistance unbalance shall be carried out in accordance with 7.3 of IEC 60708.

6.1.3 Dielectric strength

The measurement of dielectric strength shall be carried out in accordance with 5.2 of IEC 60189-1 for conductor/conductor and conductor/screen.

6.1.4 Insulation resistance

The measurement of insulation resistance shall be carried out in accordance with 5.3 of IEC 60189-1. The test voltage shall be between 100 V and 500 V d.c.

6.1.5 Mutual capacitance

The measurement of mutual capacitance shall be carried out in accordance with 5.4 of IEC 60189-1.

6.1.6 Capacitance unbalance pair to pair

The measurement of capacitance unbalance pair to pair shall be carried out in accordance with 5.5 of IEC 60189-1. The elements not under test shall be connected together and to the screen if present.

For lengths other than 1 km, the measurement value shall be divided by the following factor:

$$0{,}5 \times \left(L/1\,000 + \sqrt{L/1\,000} \right)$$

where L is the length of the measured cable in metres.

6.1.7 Capacitance unbalance pair to ground

The measurement of capacitance unbalance pair to ground shall be carried out in accordance with 5.5 of IEC 60189-1.

For lengths other than 1 km, the capacitance unbalance pair to ground is length proportional.

6.1.8 Resistance of the screen

The measurement of d.c. resistance of the screen shall be carried out accordance with 5.1 of IEC 60189-1.

6.2 Transmission tests

All the tests shall be carried out on a cable length of 100 m unless otherwise specified.

6.2.1 Velocity of propagation, delay and differential delay (delay skew)

Measurement of the velocity of propagation shall be carried out in accordance with 3.3.1 of IEC 61156-1.

Delay and delay skew shall be calculated in accordance with 3.3.1 of IEC 61156-5.

6.2.2 Attenuation

Measurement of the attenuation shall be carried out in accordance with 3.3.2 of IEC 61156-1.

6.2.3 Unbalance attenuation

Measurement of the unbalance attenuation shall be carried out in accordance with 3.3.3 of IEC 61156-1.

6.2.4 Near-end crosstalk

Measurement of the near-end crosstalk shall be carried out in accordance with 3.3.4 of IEC 61156-1.

6.2.5 Far-end crosstalk

Measurement of the far-end crosstalk shall be carried out in accordance with 3.3.5 of IEC 61156-1.

$$\text{EL FEXT}_{100} = \text{IO FEXT}_{\text{meas}} - \alpha_{100} \times L_o/100 + 10\log_{10}(L_o/100)$$

where

EL FEXT_{100} is the equal level far-end crosstalk at a length of 100 m;

$\text{IO FEXT}_{\text{meas}}$ is the measured input-to-output far-end crosstalk;

α is the attenuation of the cable in dB/100 m;

L_o is the length of the measured cable in metres.

6.3.7 Tensile strength of the sheath

Measurement of the tensile strength of the sheath shall be carried out in accordance with 9.2 of IEC 60811-1-1.

6.3.8 Crush test of the cable

Measurement of the crush resistance of the cable shall be carried out in accordance with 3.3.6 of IEC 62012-1.

6.3.9 Bending under tension of the cable

Measurement of the bending under tension shall be carried out in accordance with 3.4.8 of IEC 61156-1.

6.3.10 Impact test of the cable

Measurement of the impact resistance of the cable shall be carried out in accordance with 8.5 of IEC 60811-1-4.

6.3.11 Cold bend test of the cable

Measurement of the cold bend of the cable shall be carried out in accordance with 8.2 of IEC 60811-1-4.

6.3.12 Static load test of the cable

Under consideration.

6.4 Environmental tests

6.4.1 Thermal oxidative stability (OIT-test)

A 30-cm length of cable, with its ends sealed, shall be conditioned in an oven for 14 days at 70 °C. At the end of the conditioning period, one sample of each colour of insulation shall be removed from the cable, any filling compound present removed by wiping with a dry towel, and the measurement of OIT (Oxidation Induction Time) of the insulation carried out at 200 °C in accordance with Appendix B of IEC 60811-4-2.

The insulation shall be removed from the conductor prior to testing.

6.4.2 Shrinkage of insulation

Measurement of the shrinkage of the insulation shall be carried out in accordance with Clause 10 of IEC 60811-1-3.

6.4.3 Wrapping test of insulation after thermal ageing

Measurement of testing the wrapping of the insulation after thermal ageing shall be carried out in accordance with Clause 9 of IEC 60811-4-2.

6.4.4 Bending test of insulation at low temperature

Measurement of testing the cold bend of the insulation shall be carried out in accordance with 8.1 of IEC 60811-1-4.

6.4.5 Elongation at break of the sheath after thermal ageing

Measurement of the elongation at break of the sheath after thermal ageing shall be carried out in accordance with Clause 8 of IEC 60811-4-2.

6.4.6 Tensile strength of the sheath after thermal ageing

Measurement of the strength of the sheath after thermal ageing shall be carried out in accordance with Clause 8 of IEC 60811-4-2

6.4.7 Sheath pressure test at high temperature

Under consideration.

6.4.8 Static load test of the cable

Under consideration.

6.4.9 Flame propagation characteristics of a single cable

Measurement of the flame propagation of a single cable shall be carried out in accordance with IEC 60332-1-1.

6.4.10 Water penetration test

Measurement of water penetration in a cable shall be carried out in accordance with method F5B of IEC 60794-1-2.

6.4.11 Wicking test

6.4.11.1 Equipment

a) Beaker: 500 ml to 1 000 ml

b) Laboratory stand: with movable crossbar

c) Weight: 25 g, lead sinker type (3)

d) Fluorescein dye solution: 0,1 g/litre of water

e) Filter paper 25 mm × 25 mm (3 pieces)

6.4.11.2 Procedure

a) Cut three (3) lengths of material, approximately 450 mm long, to be tested and attach lead sinker type weights to one end of each sample.

b) Attach the opposite end of each sample length to the crossbar with minimum 25 mm space between samples. See Figure 1.

c) Attach one section of filter paper to each sample with a paper clip, approximately 75 mm above the weight.

d) Fill the beaker with the fluorescein solution to a depth of about 75 mm.

e) Position the crossbar with attached, hanging samples in place directly over the filled beaker. Lower crossbar so that the weighted sample end enters the solution positioning the bottom of the filter paper 25 mm above the surface. Record time of entry.

f) The sample shall be considered "non-wicking" if the solution does not wick and wet the lower edge of the filter paper within 6 h.

6.2.6 Characteristic impedance

6.2.6.1 Open-/short-circuit impedance (input impedance)

Measurement of the input impedance shall be carried out in accordance with 3.3.6.2.2 of IEC 61156-1.

6.2.6.2 Function fitted impedance/mean characteristic impedance

Measurement of the mean impedance shall be carried out in accordance with 3.3.6.3, or 3.3.6.3/3.3.6.2.3 of IEC 61156-1.

6.2.7 Return loss (RL)

Measurement of the return loss shall be measured in accordance with 3.3.7 of IEC 61156-1.

6.2.8 Screening attenuation

Measurement of the screening attenuation shall be measured in accordance with IEC series 62153.

6.2.9 Transfer impedance

Measurement of the transfer impedance shall be measured in accordance with IEC series 62153.

6.3 Mechanical and dimensional tests of the finished cable

6.3.1 Dimensions

Measurement of the dimensions shall be carried out in accordance with IEC 60811-1-1.

6.3.2 Elongation at break of the conductor

Measurement of the elongation at break of the conductor shall be carried out in accordance with 3.3 of IEC 60189-1.

6.3.3 Elongation at break of the insulation

Measurement of the elongation at break of the insulation shall be carried out in accordance with 9.1 of IEC 60811-1-1.

6.3.4 Elongation at break of the sheath

Measurement of the elongation at break of the sheath shall be carried out in accordance with 9.2 of IEC 60811-1-1.

6.3.5 Elongation at break of the finished cable

Measurement of the elongation at break of the finished cable (under consideration) will be carried out in accordance with IEC 60794-1-2.

6.3.6 Breaking strength of the cable

Measurement of the breaking strength of the cable shall be carried out in accordance with 3.3.8 of IEC 62012-1.

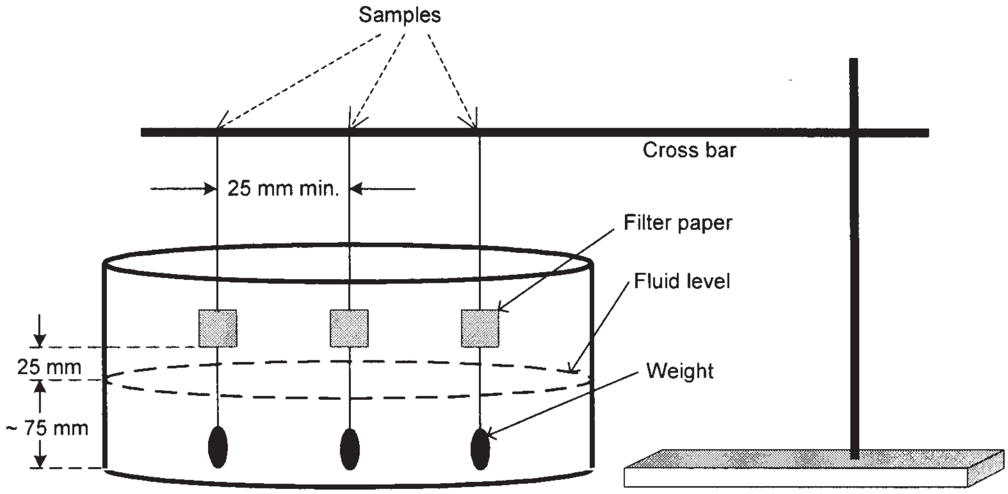

Figure 1 – Wicking test configuration

6.4.12 Hygroscopicity

The material is considered to be non-hygroscopic when a dry sample of the material is placed in an environment of 65 % ± 5 % relative humidity and 20 °C ± 1 °C for 3 h and the amount of moisture gained does not exceed 1 % by weight.

6.4.13 UV resistance

Under consideration.

Bibliography

IEC 60344, *Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires*

IEC 60794-1-1:2001, *Optical fibre cables – Part 1-1: Generic specification – General*

(*Continued from second cover*)

International Standard	*Title*
IEC 60332-1-1	Tests on electric and optical fibre cables under fire conditions — Part 1-1: Test for vertical flame propagation for a single insulated wire or cable — Apparatus
IEC 60708 : 2005	Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath
IEC 60794-1-2	Optical fibre cables — Part 1-2: Generic specification — Basic optical cable test procedures
IEC 60811-1-1 : 1993	Common test methods for insulating and sheathing materials of electric and optical cables — Part 1-1: Methods for general application — Measurement of thickness and overall dimensions — Test for determining the mechanical properties
IEC 60811-1-3 : 1993	Common test methods for insulating and sheathing materials of electric and optical cables — Part 1-3: General application — Methods for determining the density — Water absorption test — Shrinkage test
IEC 60811-1-4 : 1985	Common test methods for insulating and sheathing materials of electric cables — Part 1: Methods for general application — Section 4: Tests at low temperature
IEC 60811-4-2 : 2004	Insulating and sheathing materials of electric and optical cables — Common test methods — Part 4-2: Methods specific to polyethylene and polypropylene compounds — Tensile strength and elongation at break after conditioning at elevated temperature — Wrapping test after thermal ageing in air — Measurement of mass increase — Long-term stability test — Test method for copper-catalyzed oxidative degradation
IEC 61156-1 : 2002	Multicore and symmetrical pair/quad cables for digital communications — Part 1: Generic specification
IEC 61156-5 : 2002	Multicore and symmetrical pair/quad cables for digital communication — Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz — Horizontal floor wiring — Sectional specification
IEC 62012-1 : 2004	Multicore and symmetrical pair/quad cables for digital communications to be used in harsh environments — Part 1: Generic specification

Only the English language text in the International Standard has been retained while adopting it in this Indian Standard, and as such the page numbers given here are not the same as in the IEC Publication.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard alongwith amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of ‘BIS Catalogue’ and ‘Standards: Monthly Additions’.

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Amendments Issued Since Publication

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